CLAIMS

1. A substrate processing apparatus comprising: a reaction furnace for processing a substrate; a seal cap for sealing the reaction furnace hermetically; a cover installed separately from the seal cap so as to cover at least a section of the surface of the seal cap facing the inner side of the reaction furnace; a small chamber formed at least by the seal cap and the cover; a feed opening for supplying a first gas to the small chamber; a flow outlet provided in the small chamber for making the first gas flow into the reaction furnace; and a feed opening provided further downstream than the flow outlet, for supplying a second gas into the reaction furnace.

2. The substrate processing apparatus according to claim 1, wherein the small chamber is formed by the seal cap and the cover and the inner wall surface of the reaction furnace; and the flow outlet is formed by a clearance between the cover and the inner wall surface of the reaction furnace.

3. The substrate processing apparatus according to claim 2, wherein the reaction furnace includes a process tube, and a furnace opening flange for supporting the process tube; and the small chamber is formed by the seal cap and the cover and the inner wall surface of the furnace opening flange; and the flow outlet is formed by a clearance between the inner wall surface of the furnace opening flange and the cover.

4. The substrate processing apparatus according to claim 3, wherein the furnace opening flange includes an inlet flange for supporting the process tube, and a base flange for supporting the inlet flange; and the small chamber is formed by the inner wall surface of the base flange and the cover and the seal cap; and the flow outlet is formed by a clearance between the inner wall surface of the base flange and the cover.

5. The substrate processing apparatus according to claim 4, wherein the feed opening for supplying the first gas is provided in the base flange; and the feed opening for supplying the second gas is provided in the inlet flange.

6. The substrate processing apparatus according to claim 1, wherein the cover is formed by a plate-shaped member.

7. The substrate processing apparatus according to claim 1, comprising a boat for holding multiple substrates approximately horizontally at intervals in multiple stages, and a rotation mechanism for supporting and rotating the boat by way of a rotating shaft penetrating through the seal cap, wherein the cover is installed in the rotating shaft.

8. The substrate processing apparatus according to claim 1, wherein the first gas is ammonia, the second gas is dichlorosilane, and a silicon nitride film is formed on the substrate by the thermal CVD method in the processing.

9. A substrate processing apparatus comprising: a reaction furnace for processing a substrate; a seal cap for sealing the reaction furnace hermetically; a first cover installed separately from the seal cap so as to cover at least a section of the surface of the seal cap facing the inner side of the reaction furnace; a first small chamber formed by the seal cap and the first cover, a first feed opening for supplying a first gas to the first small chamber; a first flow outlet provided in the first small chamber for making the first gas flow into the reaction furnace; a second cover installed separately from the inner wall surface of the lower section of the reaction furnace so as to cover at least a portion of the inner wall surface of the lower part of the reaction furnace; a second small chamber formed by the second cover and the inner wall surface of the lower part of the reaction furnace; a second feed opening for supplying a second gas to the second small chamber; and a second flow outlet provided in the second small chamber for allowing the second gas to flow into the

reaction chamber.

10. The substrate processing apparatus according to claim 9, wherein a ring-shaped member is installed on the seal cap, the first small chamber is formed by the seal cap and the first cover and the ring-shaped member; and the second small chamber is formed by the inner wall surface of the lower part of the reaction furnace and the second cover and the ring-shaped member.

11. The substrate processing apparatus according to claim 10, wherein the first flow outlet is formed by a clearance between the first cover and the ring-shaped member; and the second flow outlet is formed by a clearance between the second cover and the ring-shaped member.

12. The substrate processing apparatus according to claim 11, comprising a boat for holding multiple substrates approximately horizontally at intervals in multiple stages, wherein the reaction furnace includes a process tube comprised of an inner tube and an outer tube, and a furnace opening flange for supporting the process tube; and the first cover is comprised of an end plate on the lower side of the boat, and the second cover is comprised of an extending section of the inner tube extending downwards from the protrusion for installing the inner tube on the furnace opening flange.

13. The substrate processing apparatus according to claim 9, wherein there is no metal member inside the reaction furnace for mixing the first gas flowing from the first flow outlet with the second gas flowing from the second flow outlet.

14. The substrate processing apparatus according to claim 9, wherein the first feed opening for supplying the first gas is formed by a clearance between the seal cap and the rotating shaft.

15. The substrate processing apparatus according to claim 9, wherein the first gas is ammonia, and the second gas is dichlorosilane, and a silicon nitride film is formed

on the substrate by the thermal CVD method in the processing.

16. A substrate processing apparatus comprising: a reaction furnace for processing a substrate; a seal cap for sealing the reaction furnace hermetically; a first cover installed separately from the seal cap so as to cover at least a section of the surface of the seal cap facing the inner side of the reaction furnace; a first small chamber formed by the seal cap and the first cover, a first feed opening for supplying a first gas to the first small chamber; a first flow outlet provided in the first small chamber for allowing the first gas to flow into the reaction furnace; a second cover installed separately from the inner wall surface of the lower section of the reaction furnace so as to cover at least a portion of the inner wall surface of the lower part of the reaction furnace; a second small chamber formed by the second cover and the inner wall surface of the lower part of the reaction furnace; a second feed opening for supplying a second gas to the second small chamber; and a second flow outlet provided in the second small chamber for allowing the second gas to flow into the reaction chamber, and a third feed opening provided further downstream than the first flow outlet and the second flow outlet for supplying a third gas into the reaction furnace.

17. The substrate processing apparatus according to claim 16, wherein the first gas and the second gas are ammonia, and the third gas is dichlorosilane, and a silicon nitride film is formed on the substrate by the thermal CVD method in the processing.

18. A semiconductor device manufacturing method comprising the steps of: loading a substrate into a reaction furnace; sealing the reaction furnace hermetically with a seal cap; processing the substrate by supplying a first gas into a small chamber formed by the seal cap and a cover installed separately from the seal cap so as to cover at least a section of the surface of the seal cap facing the

inner side of the reaction furnace, along with making the first gas flow into the reaction furnace from a flow outlet provided in the small chamber, and supplying a second gas into the reaction furnace from a second feed opening provided further downstream than the flow outlet; and unloading the substrate from the reaction furnace.

19. A semiconductor device manufacturing method comprising the steps of: loading a substrate into a reaction furnace; sealing the reaction furnace hermetically with a seal cap; processing the substrate by supplying a first gas into a small chamber formed by the seal cap and a first cover installed separately from the seal cap so as to cover at least a section of the surface of the seal cap facing the inner side of the reaction furnace, along with allowing the first gas to flow into the reaction furnace from a flow outlet provided in the small chamber, supplying a second gas into a second small chamber formed by the inner surface of the lower section of the reaction furnace and a second cover installed separately from the inner surface of the lower section of the reaction furnace so as to cover at least a section of the inner surface of the lower section of the reaction furnace, and allowing the second gas to flow into the reaction furnace from a second flow outlet provided in the second chamber; and unloading the substrate from the reaction furnace.

20. A semiconductor device manufacturing method comprising the steps of: loading a substrate into a reaction furnace; sealing the reaction furnace hermetically with a seal cap; processing the substrate by supplying a first gas into a small chamber formed by the seal cap and a first cover installed separately from the seal cap so as to cover at least a section of the surface of the seal cap facing the inner side of the reaction furnace, along with allowing the first gas to flow into the reaction furnace from a flow outlet provided in the small chamber, supplying a second gas into a second small chamber formed by the inner surface of

the lower section of the reaction furnace and a second cover installed separately from the inner surface of the lower section of the reaction furnace so as to cover at least a section of the inner surface of the lower section of the reaction furnace, and allowing the second gas to flow into the reaction furnace from a second flow outlet provided in the second chamber, and supplying a third gas into the reaction furnace from further downstream than the first flow outlet and the second flow outlet; and unloading the substrate from the reaction furnace.